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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
|---|---|---|---|
| 09/038,562 | 03/11/98 | CHAO | H 63345 |

022242 LM31/0427
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| EXAMINER | |
|---|---|
| JOHNSON, T | |
| **ART UNIT** | **PAPER NUMBER** |
| 2723 | 10 |

**DATE MAILED:** 04/27/00

**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trademarks**

# Office Action Summary

| Application No. | Applicant(s) |
|---|---|
| 09/638,562 | Chao et al. |
| **Examiner** | **Group Art Unit** |
| Timothy M. Johnson | 2723 |

*—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

**Status**

☒ Responsive to communication(s) filed on 3/14/00.

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 1 1; 453 O.G. 213.

**Disposition of Claims**

☒ Claim(s) 1-32 is/are pending in the application.

Of the above claim(s) 1-15 & 22-32 is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 16-21 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement.

**Application Papers**

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☒ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. § 119 (a)-(d)**

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received: _____.

**Attachment(s)**

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 5 & 6

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

**Office Action Summary**

**Part III Detailed Action**

## Election/Restriction

1. Claims 1-15 and 22-32 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made without traverse in paper no. 9.

2. Applicant's election without traverse of species III, claims 16-21, in Paper No 9 is acknowledged.

## Drawings

3. This application has been filed with informal drawings which are acceptable for examination purposes only. Formal drawings will be required when the application is allowed.

## Disclosure

4. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The Examiner suggests the following title:

"Image compression and decompression based on an integer wavelet transform using a lifting scheme and a correction method".

5. USPTO (United States Patent and Trademark Office) policy does not permit the USPTO to hyperlink to any commercial site, since the USPTO exercises no control over the organization, views, or accuracy of the information contained on these outside sites. Hyperlinks and/or other forms of browser-executable code embedded in the text of the patent application are impermissible, and should be deleted. Specifically, Applicant should delete the hyperlinks and/or browser-executable code on page 45, lines 12-15, and page B-11, lines 15-16. Correction is required.

## Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 16-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Chui et al., 5,604,824, Calderbank et al., Wavelet Transforms That Map Integers to Integers, and Said et al., An image multiresolution representation for lossless and lossy compression.

For claim 16, an image compression system comprising a compressor configured to generate a compressed image is provided by Chui et al. in c. 15, lines 33-39 (an image compression system), and based on an integer wavelet transform is further provided by Chui et al. in the abstract, lines 6-10; c. 3, line 64 – c. 4, line 2; c. 4, lines 47-56; c. 23, lines 55-64; c. 25, line 66 – c. 26, line 3; c. 24, lines 49-52; c. 27, lines 44-54; 28, lines 49-58, c. 34, lines 36-47; c. 45, lines 4-15; Fig. 2, blocks 48a, 48b, and 48c; and Fig. 17, blocks 134a, 134b, and 134c.

Chui et al. does not explicitly provide for the well known lifting scheme to obtain integer wavelet transforms, but does provide for the claimed selecting from different integer wavelet transforms as shown in Fig. 2, blocks 48a, 48b, and 48c, from which, one of three wavelet transforms is selected, as noted in c. 15, lines 33-52. Calderbank et al. teaches that it is well known to use the lifting scheme for integer wavelet transforms starting on page 19, section 3. It would've been obvious to one having ordinary skill in the art at the time the invention was made to use a lifting scheme, as taught by Calderbank et al., with one of the transforms of Chui et al. in Fig. 2, blocks 48a, 48b, or 48c, since "Lifting is a flexible technique that has been used in several different settings, for an easy construction and implementation of "traditional" wavelets [32], and of "second generation" wavelets [33]", "lifting allows us to immediately find the inverse" even "though the transform now is non-linear", as "long as the transform is written using lifting, the inverse transform can be found immediately", and because "lifting allows us to obtain an integer transform using simply truncation and without losing invertibility" as taught by Calderbank et al. on page 20, lines 14-16, and page 21, line 1, line 8, and lines 15-16.

Chui et al. does not explicitly provide for the well correction method to obtain integer wavelet transforms, but does provide for the claimed selecting from different integer wavelet transforms as shown in Fig. 2, blocks 48a, 48b, and 48c, from which, one of three wavelet transforms is selected, as noted in c. 15, lines 33-52. Said et al. teach that it is well known to use the correction method for integer wavelet transforms starting in the paragraph bridging pages 1303 – 1304 and primarily in section II on page 1304, where the S+P transform used by Said et al. is a correction method (that Said et al. provide for a "correction method" is further indicated by the Applicant's specification on page 38, lines 13-15). It would've been obvious to one having ordinary skill in the art at the time the invention was made to use a correction method, as taught by Said et al., with one of the transforms of Chui et al. in Fig. 2, blocks 48a, 48b, or 48c, since "the S+P transform yields more compression than single-resolution linear predictive coding methods of similar complexity, and can be calculated with a very small computational effort", because Said et al. "propose entropy-coding methods that exploit the multiresolution structure and that can efficiently compress the S+P transformed image for progressive-resolution transmission", because Said et al. "propose an embedded coding method, and show that its rate distortion function is comparable to those of the most efficient lossy compression methods" for "progressive-fidelity transmission", and that the "compression rates obtained with both types of progressive transmission are among the best in the literature", so that "with the proper image transformation, fast inspection schemes can be readily combined with lossless compression, resulting in a negligible penalty in both compression efficiency and coding complexity", as taught by Said in the paragraph bridging pages 1303-1304.

For claim 17, the image compression system of claim 16, wherein the compressor quantizes a wavelet transformed image to produce the compressed image is provided by Chui et al. in block 50 of Fig. 2 and c. 15, lines 53-59.

For claim 18, the image compression system of claim 16, wherein the compressor entropy encodes (e.g. Huffman or arithmetic) a quantized image to produce the compressed image is provided by Chui et al. in c. 15, line 66 – c. 16, line 1 with respect to Fig. 2, block 52, as

implemented by apparatus block 64 in Fig. 4, which can be any one of several entropy coders as noted in c. 17, lines 51-65.

For claim 19, the image compression system of claim 16, wherein the compressor performs a color transformation to produce the compressed image is provided by Chui et al. in c. 9, lines 26-44, where the image is color transformed from any one of several different image formats into RGB. Additionally, a color transform can also be construed as the color transform reduction process of Chui et al. in c. 10, line 55 – c. 11, line 2, where a dithering process and mapping colors from a color histogram are certainly color transformations as well, and which transforms provide for further compression as noted in c. 15, lines 10-31.

For claim 20, an image decompression system comprising a decompressor configured to generate a decompressed image based on an integer inverse wavelet transform derived using a technique selected from one of more than one method is provided by Chui et al. where cited above for claim 16, and in c. 4, lines 47- 60; c. 27, lines 55-61; c. 36, lines 60-67; c. 39, lines 8-22; c. 40, lines 10-12 and lines 48-31; c. 41, lines 41-51; c. 42, lines 27-28; c. 45, lines 4-15; Fig. 17, blocks 134a, 134b, and 134c. The particular technique is selected in at least c. 15, lines 39-52 and the paragraph bridging cols. 38-39, with respect to Fig. 2, blocks 48a, 48b, and 48c (compression), and Fig. 17, blocks 134a, 134b, and 134c (decompression). That the lifting scheme and a correction method are used in a decompression system are obvious for the same reasons noted above for claim 16, of which arguments apply here and are incorporated herein. As a further note on decompression, in the "correction method" provided by Said et al., they recite that the inverse transform, i.e. that which is necessary to obtain the image in the decompression process, is basically the reverse of the transformation in the left col. on page 1305, about the last 16 lines of section II including equation 9, much like the decompression process of Chui et al. "performing substantially the inverse operations of" the compression system, "and as such uses quite similar circuitry to accomplish the same" – last sentence in c. 36 of Chui et al. Similarly, Calderbank et al., who provide for the conventional and well known lifting scheme noted above, also provide for an inverse transform in accordance with the lifting

scheme, which is basically the reverse of the forward transform, on page 20, last six lines, and the inverse transform is again recited on page 21, line 1, lines 8-14.

8. Claim 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Chui et al., 5,604,824, and Rich et al., 5,831,625.

For claim 21, there is a very subtle difference between the claim and the reference of Chui et al., which is that the claim requires a computer-readable medium storing a computer program for directing a computer system to perform image compression, wherein the computer program implements steps for performing a wavelet transform of an input image, quantizing the wavelet transformed image, entropy coding the quantized image, and outputting a file that includes the entropy coded image, while Chui et al. provide for all of these acts by separate programs instead of a single program.

Chui et al. provide for all of the claimed limitations (albeit separate programmed processors) as follows: Chui et al. provide for a computer-readable medium storing a computer program for the wavelet transform of an input image in c. 16, lines 34-64, Fig. 2, blocks 48a – 48c, and Fig. 4, blocks 60 and 65. In a separate computer-readable medium storing a computer program, Chui et al. provide for quantizing the wavelet transformed image in c. 17, lines 14-28, Fig. 4, block 62, and Fig. 2, block 50. In another separate computer-readable medium storing a computer program, Chui et al. provide for entropy coding (e.g. Huffman or arithmetic) in c. 17, lines 51-65 ("programmed") and Fig. 4, block 64 (note that the TMS320C30 is also used in the wavelet transform, which is recited to include program code in c. 16, lines 51-52, and can also be used with the entropy coder, c. 17, lines 52-54), which is further capable of outputting a compressed image "file" as shown in Fig. 1, blocks 22 and 24, Fig. 2, block 54, and Fig. 4, block 68, and as noted in c. 7, lines 27-32, and in the first five lines of c. 16, where the compressed image is appropriately formatted for disk or archival storage, which is tantamount to a compressed image file.

Thus, Chui et al. provides for all of the limitations except for the minor difference of having more than one computer-readable mediums storing computer programs as opposed to the claimed implied singular computer program. Rich et al. similarly provide for a wavelet

transform, quantization, entropy coding, and storage (although not explicitly for a file, but a file is already provided by Chui et al.) in c. 18, lines 12-27, c. 20, lines 6-15, and Fig. 10. Rich et al. provide for performing these acts in "the form of a computer program product on a computer-readable storage medium having computer-readable program code means embodied in the medium" and that any "suitable computer readable medium may be utilized" in c. 4, lines 3-6. It would've been obvious to one having ordinary skill in the art at the time the invention was made to use a computer-readable program code means" in place of the programs of Chui et al. as taught by Rich et al., since this provides for the advantage of portability as well as the advantage of being stored in different forms such as several different devices as noted in c. 4, lines 6-8 of Rich et al.

**Citation of Relevant art**

9. The art made of record and not relied upon is considered pertinent to applicant's disclosure.

Chao et al., An Approach to Integer Reversible Wavelet Transformations for Lossless Image Compression - Page 11, lines 16-18 for a correction method, which refers to reference 3 on page 17 as a typical correction method example. Reference 3 is by Amir Said, An image multiresolution representation for lossless and lossy compression. Reference found via infoseek by searching for (wavelet and correction).

Calderbank et al., Lossless image compression using integer to integer wavelet transform – not prior art, but reference 5 listed on page 599 is.

Munteanu et al., Wavelet Lossless Compression of Coronary Angiographic Images – Integer wavelet transform, but not prior art, but does provide link to wavelet lifting schemes via reference 1 on page 186.

**Contact Information**

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy M. Johnson whose telephone number is (703) 306-3096.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3900.

The Group Art Unit FAX numbers are (703) 308-5397 and (703) 306-5406.

Timothy M. Johnson
TIMOTHY M. JOHNSON
PATENT EXAMINER

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Timothy M. Johnson
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Art Unit 2723
April 24, 2000